CLAIMS

1.   A method for deep drawing a product from a blank, in which, during
deep drawing, the blank is held near its edge by a downholder against a die
ring cooperating with the downholder, thereby preventing, at least reducing
wrinkle formation in the blank, by controlling the downholder,

5   characterized in that at the beginning of deep drawing the downholder (8) is
adjusted such that a downholder force (F_N) exerted by the downholder (8) on
the edge (6) of the blank (5) is relatively small and the further control of the
downholder (3) occurs on the basis of a predetermined thickness trend of
said edge (6) during deep drawing and/or a trend or critical value derived

10   from this thickness trend.

2.   A method according to claim 1, characterized in that during deep
drawing a parameter relevant to the wrinkle formation is measured and
compared with a critical value at which wrinkle formation occurs, which
critical value is predetermined, based on the thickness trend of the blank

15   edge (6) and/or a signal derived from this thickness trend, and in which,
when the measured parameter exceeds or threatens to exceed this critical
value, the downholder (8) is controlled such that a downholder force (F_N)
exerted on the edge (6) by the downholder (8) increases and the measured
parameter falls below the critical value.

20   3.   A method according to claim 2, characterized in that the parameter
relevant to wrinkle formation is the downholder opening (s_o), defined as the
perpendicular distance between the downholder (8) and the die ring (10),
and the critical value is the predetermined thickness trend or the
predetermined maximum thickness increase of the edge (6).

25   4.   A method according to claim 2, characterized in that the parameter
relevant to wrinkle formation is the speed (v_o) at which the downholder
opening changes, and the critical value is the predetermined speed trend or

the predetermined maximum speed at which the blank edge increases in thickness during deep drawing.

5.   A method according to any one of claims 2-4, characterized in that the critical value is measured during a testing session, previous to deep drawing.

6.   A method according to any one of claims 2-4, characterized in that the critical value is simulated by means of a dynamic model of the blank (5) and the deep drawing process.

7.   A method according to claim 1, in which the position of the downholder (8) is controlled according to a predetermined range, such that during deep drawing the downholder opening (s_o), defined as the perpendicular distance between the downholder (8) and the die ring (10) substantially corresponds with a predetermined thickness trend of the edge (6) to be expected during deep drawing.

8.   An apparatus for deep drawing a product from a blank (5), comprising a downholder (8), a die ring (10) cooperating therewith, for holding an edge (6) of the blank (5) during deep drawing, a control (12) provided with means for storing therein a desired downholder opening trend (s_o), downholder opening speed trend (v_o) and/or a critical value derived therefrom, and positioning means (9) for moving the downholder (8), the control (12) being arranged to control the positioning means (9) such that the movement of the downholder (8) is in agreement with the stored downholder opening trend (s_o), downholder opening speed trend (v_o) and/or a critical value derived therefrom.

9.   An apparatus according to claim 8, in which the control (12) is arranged to control the positioning means (9) such that a distance between the downholder (8) and the die ring (10) is in agreement with the stored downholder opening trend (s_o) or a critical value derived therefrom.

10.   An apparatus according to claim 8 or 9, in which measuring means (11) are provided to measure the downholder opening trend (s_o), the

downholder opening speed trend (v_o) and/or a critical value derived therefrom, and in which the control (12) comprises means for comparing signals measured with the measuring means (11) with a downholder opening trend (s_o), downholder opening speed trend (v_o), stored in the

5   control (12) and/or a critical value derived therefrom, and in which the control (12) is arranged to control, on the basis thereof, the downholder (8) such that the movement, speed or critical value of the downholder (8) derived therefrom is in agreement with the stored downholder opening trend, downholder opening speed trend and/or the critical value derived

10   therefrom.

11.   A apparatus according to any one of claims 8-10, characterized in that the measuring means (11) comprise a contactless sensor, for instance an optical, capacitive or magnetic sensor.